SIGGRAPH 79

IMLAC® CORPORATION

DYNAGRAPHIC™

Refreshed, Interactive Graphics

A Hazeltine Company

DYNAGRAPHIC™

Interactive graphic terminals

IMLAC's DYNAGRAPHIC Series presents hassle-free graphics for high resolution, interactive applications. All DYNAGRAPHIC terminals are intelligent and come complete with firmware. With our Fortran package on your Host, you can immediately utilize the terminal's interactive capabilities. Complicated, expensive interactive graphics is a thing of the past with DYNAGRAPHICS.

All DYNAGRAPHIC Systems provide a large work surface and include user's choice of a Light Pen or Joystick (Tablet, optional). They support Pen Plotters, Printer/Plotters and Digitizers.. Additional memory is optional.

Specifications subject to modification.

BASIC DYNAGRAPHIC SPECIFICATIONS

Model 3205 Most Economical	Model 6210 Double the Display Capacity of 3205	Model 6220 Supports two (2) stations - totally interactive
16K word, 990 ns Semiconductor Memory	16K word, 660 ns Semiconductor Memory	32K word, 660 ns Semiconductor Memory
19" CRT (diagonal), P39 Phosphor, 10½" × 10½" Viewing Area		
92-Key Keyboard with 8 lighted Function Keys		
Full 96 ASCII set, stroke-drawn characters, 7 sizes plus Eight (8) User-callable Graph Markers		
RS-232 Serial Asynchronous Interface Five Speeds, switch selectable: 300, 1200, 2400, 4800 or 9600 baud		
Brightness: 40 ft lamberts		
16 Intensity Levels plus Blinking and Line Texture		
Contrast: 30 to 1		
Addressable Resolution 2048 × 2048		

The Model 3205 provides totally dynamic, interactive graphics at storage-tube prices. And, an EMULATOR for the Tektronix 4014/4010 is available as an option, permitting immediate use of PLOT-10 programs. We can supply GINO compatible firmware, too.

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Summary of DYNAGRAPHICS Host Routines (Fortran)

General Routines

GSETUP	Initialize host package and terminal program
GCLOSE	Terminate use of graphics package
GSCRND	Set/modify visible elements of screen display
GERROR	General error routine
GRESET	Total graphics reset
GWAITF	Wait for 'n' seconds
GXMITA	Transmit alphanumeric data
GXMITG	Transmit graphic data
GHCOPY	Make a hard-copy of the display screen
GDLCLN	Reclaim terminal display list space
GCONVT	Number extraction from text string

Transformation Routines

GTRANS	Set default transformation mapping
GPICTR	Set virtual picture limits
GPWIND	Set virtual picture window limits
GPVIEW	Set virtual picture and virtual picture window limits
GSVIEW	Set screen viewport limits
GTSAVE	Save current transformation mapping
GTREST	Restore previously saved transformation mapping

Element Construction Routines

GDRWPT	Draw a point
GDRWMK	Draw a pre-defined marker symbol
GDRWLN	Draw a line
GDRWTX	Draw a text string
GDRWAC	Draw an arc
GDRWCI	Draw a circle
GDRWPO	Draw a polygon
GDRWST	Draw a structure
GDRWTO	Draw to an absolute location
GDRWBY	Draw by a specified amount
GMOVTO	Move to an absolute location
GMOVBY	Move by a specified amount

Segment Definition and Manipulation Routines

GSEGOP	Open a new segment
GSEGCL	Close currently open segment
GSEGAT	Modify a segment's display attributes
GSEGON	Turn on a segment
GSEGOF	Turn off a segment
GSEGIN	Modify a segment's display intensity
GSEGPO	Position a segment
GSEGDE	Delete a segment
GSEGDR	Drag a segment
GSEGRO	Reopen an existing segment
GSEGRN	Rename a segment
GSEGCP	Copy a segment into another segment

Group Definition and Manipulation Routines

IGROUP	Return group to which specified segment belongs
GGRPOP	Open a new group
GGRPCL	Close currently open group
GGRPAT	Modify a group's display attributes
GGRPON	Turn on a group
GGRPOF	Turn off a group
GGRPIN	Modify a group's display intensity
GGRPPO	Position a group
GGRPDE	Delete a group
GGRPDR	Drag (translate) a group
GGRPRO	Reopen an existing group

Menu Definition and Handling Routines

GMENUS	Construct a menu
GMENON	Turn on a menu (or menu item)
GMENOF	Turn off a menu (or menu item)
GMENDE	Delete a menu (or menu item)
GMENAC	Activate a menu
GDIGIT	Accept numeric input from special digit-panel menu

Event Enabling/Disabling Routines

GCLREV	Clear an event-type from the event queue
GENBEV	Enable an event type
GDISEV	Disable an event type
GENBFK	Enable any fuction key
GDISFK	Disable any fuction key
GENB1K	Enable one function key
GDIS1K	Disable one fuction key

Event Reporting Routines

GCURSR	Set graphic cursor type and position
GTXTBF	Alter text event buffer parameters
GCHRIM	Retrieve key event (with prompt)
GCHRRIN	Retrieve key event (no prompt)
GTXTIM	Retrieve text event (with prompt)
GTXTIN	Retrieve text event (no prompt)
GPOSIM	Retrieve position event (with prompt)
GPOSIN	Retrieve position event (no prompt)
GENTIM	Retrieve pointing event (with prompt)
GENTIN	Retrieve pointing event (no prompt)
GFNKIM	Retrieve function key event (with prompt)
GFNKIN	Retrieve function key event (no prompt)
GEVNIM	Retrieve any enabled event (with prompt)
GEVNIN	Retrieve any enabled event (no prompt)

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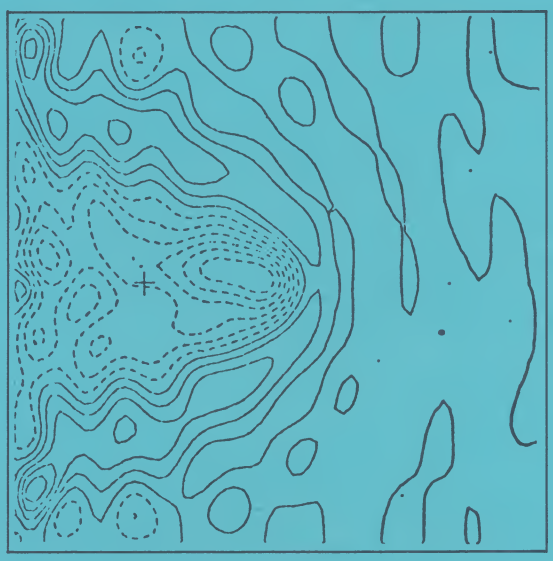
DYNAGRAPHIC™

Interactive, Refreshed Graphics at WOODS HOLE OCEANOGRAPHIC INSTITUTION

For scientists at Woods Hole Oceanographic Institution (Cape Cod, Massachusetts), an IMLAC DYNAGRAPHIC Interactive, Refresh Graphics Terminal (installed on the Institution's new VAX11/780 computer) is providing a powerful and convenient way to study ocean dynamics. With simulated motion and dynamic displays, they are able to observe ocean circulation patterns, seismograms, velocity-depth profiles and gravity-bathymetry traces.

Digital data, gathered by the fleet of Woods Hole research ships such as ATLANTIS II and the submarine ALVIN, are brought to the Woods Hole Information Processing Center for reduction, analysis and distribution to scientists throughout the world.

Both numerical modeling and interactive graphic analysis are used. One area of research involves oceanic seismic analysis and gravity-bathymetry studies which help portray motion of the earth's crust (plate tectonics). Another area of research concerns study of ocean currents and the motion of huge eddies which carry much of the ocean's energy.



Streamfunction contours in an idealized ocean basin.

Basic Hardware/Software Configuration

A VAX11/780 computer with 512K bytes of memory, a floating point accelerator, two 176M byte disks and two 75 ips tape drives constitute the core of the new Woods Hole system. Sixteen time-sharing ports allow use of an IMLAC/DYNAGRAPHIC Model 3205 Interactive Graphics Terminal with Light Pen, a CALCOMP Digital Plotter, several storage-tube graphics terminals, a Digitizer Tablet, Teleprinter and several alphanumeric terminals.

Graphics software from the National Center for Atmospheric Research (NCAR) has been implemented on the VAX computer. The NCAR PLOT PACKAGE includes software for producing contour maps, families of curves, and three dimensional projections as well as for line drawing, character generation and other low level functions.

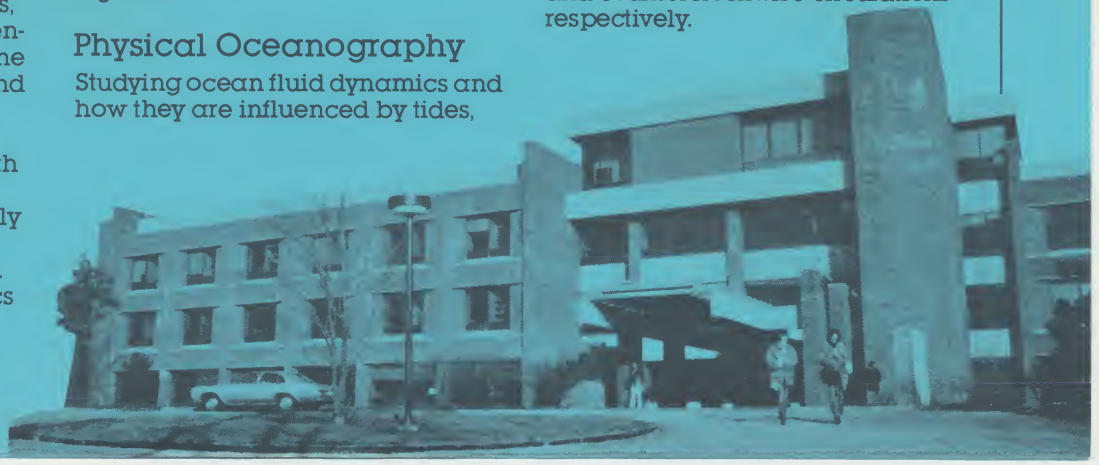
High level DYNAGRAPHIC software subroutines permit users with minimal computer knowledge to work interactively and graphically with their programs by using simple FORTRAN subroutine calls. Together, the IMLAC Host Graphics Package residing in the VAX and the terminal-resident DYNAGRAPHICS Package provide these FORTRAN-callable interactive graphic capabilities.

Since the IMLAC 3205 Terminal at Woods Hole includes the optional Tektronix* Emulator, it is conveniently used as a Previewer for the CALCOMP Plotter.

Interactive capability and ease-of-use without significant computer training make the IMLAC DYNAGRAPHIC Terminal a powerful tool for Woods Hole scientists. They are able to display the results of numerical models, to spot data irregularities, and smooth and edit data prior to printout or publication, often simply using the IMLAC Light Pen.

Physical Oceanography

Studying ocean fluid dynamics and how they are influenced by tides, winds and the earth's rotation is easier with interactive graphics. Dale Haidvogel, Woods Hole oceanographer (shown on reverse side), uses the VAX/IMLAC DYNAGRAPHIC system to study generation and migration of huge ocean eddies (up to 200 kilometers in diameter and as long as 5 months duration). The hardcopy printout above shows the results of his experiments as he sees them on the DYNAGRAPHIC screen. With a bright image in any ambient light conditions it allows observation of fluid-dynamical variables related to the velocity field. Contours are streamlines which show the pattern of flow. Peaks (solid lines) and valleys (dashed lines) represent clockwise and counterclockwise circulations respectively.



*Tektronix is a trademark of Tektronix, Inc.

Geophysical Research

With seismic experimentation, Woods Hole scientists are studying the movement of the earth's continental plates with respect to one another. Patterns of explosive charges are set off near the ocean's surface. Acoustic signals, refracted through the earth's crustal layers beneath the ocean, are recorded by arrays of ocean-bottom hydrophones. Graphic analysis of families of seismograms generated by numerical models yields important details on the geological structures beneath the sea floor (e.g., Africa and North America are separating at a rate of about 1.5 cm per year).

Fourier analysis of the gravity and bathymetry (depths) time series as measured at closely spaced points across the world's oceans yields more information about the crustal structure of the sea bed—also easier to interpret and edit with dynamic displays.

Summary

The VAX11/780 computer was selected by Woods Hole because of its ability to run very large programs, perform fast Fourier analyses and also because it provided good support for graphics applications.

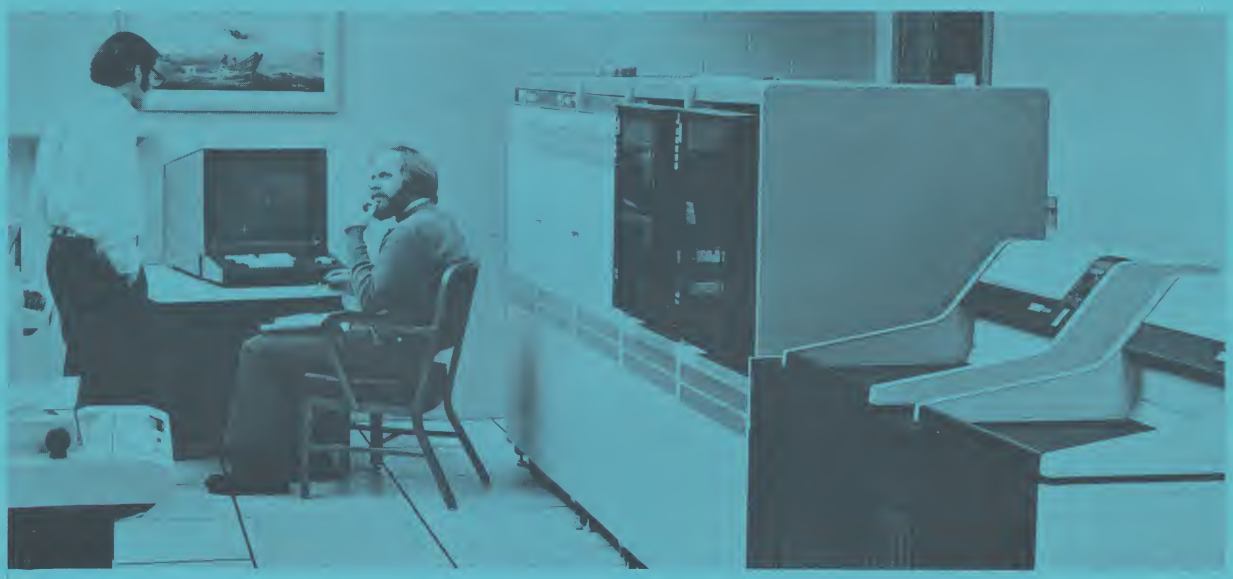
IMLAC's DYNAGRAPHIC Terminal (Model 3205) was chosen to provide the graphic display because it is the lowest priced interactive, stroke generated display terminal available. It also included the graphics software support package which allowed easy installation on the VAX system and use

with other system peripherals.

Specific benefits which are being realized include:

- **Generation and display of numerical models with simulated motion**
- **Interactive editing of large scale programs with Light Pen and Keyboard**
- **Selective Erasure without having to redraw an entire display**

A further benefit—since numerical models are frequently changed at the source code level, the VAX/IMLAC DYNAGRAPHIC system is proving most effective as a "modeling computer" compared with larger, costlier and batch-process oriented alternative computers.



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ON DISPLAY

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36 IMLAC DYNAGRAPHIC TERMINALS are in use at the Interactive Computer Graphics Center at Rennselaer Polytechnic Institute.

THE DYNAGRAPHIC™ DIFFERENCE

DYNAGRAPHIC Terminals are much more than just intelligent, interactive graphic terminals. They are fully software-supported systems which provide brilliant, high-quality, refresh graphics at storage-tube prices. In fact, they are the lowest cost, fully-supported graphics terminals available.

Key to the DYNAGRAPHIC Difference is the DYNAGRAPHICS Software which consists of two valuable components:

- **DYNAGRAPHICS LIBRARY OF FORTRAN CALLABLE ROUTINES** which allows anyone familiar with FORTRAN to begin developing interactive graphics applications immediately. These Imlac-supplied, host-resident routines generate the specific codes required by the terminal so the programmer is free to concentrate on writing applications programs.
- **DYNAGRAPHICS TERMINAL CONTROL PROGRAM** which processes commands from the host computer and helps a user interact with the display. The user doesn't need to know a command language, and the local intelligence of the DYNAGRAPHIC Terminal helps minimize the amount of host/terminal communication.

A full complement of interactive devices is supported: light pen, joystick, data tablet and digitizer. In addition, hard-copy output is available from both electrostatic and pen plotters.

All of these elements make DYNAGRAPHICS a powerful, cost-effective design tool:

- Its low cost gives you the advantages of interactive graphics at storage-tube prices.
- DYNAGRAPHICS software makes it easy to develop interactive graphics applications rapidly, while the DYNAGRAPHICS terminal software enhances the interactive capabilities of the system.
- But perhaps most importantly, DYNAGRAPHIC Terminals are easy to use. DYNAGRAPHICS helps users be more productive, because its interactive capabilities allow them to concentrate on their tasks, not on the tool they are using.

DYNAGRAPHIC™ Series

There are three models in the DYNAGRAPHIC™ series:

- Model 3205 - the most economical version, offers the interactive features of refresh graphics, at little more than than the price of a storage tube.
- Model 6210 - allows you to double the display capacity of the 3205, by using faster memory and monitor.
- Model 6220 - is a dual-display version of the 6210, supporting two users through a shared memory managed by the terminal software.

Host Software

The DYNAGRAPHICS host routines are divided into classes of functions, which include: drawing basic graphics elements such as lines and circles, performing transformations on these elements, creating and manipulating pictures and subpictures, and windowing/clipping.

To support the interactive capabilities of the DYNAGRAPHIC™ terminals, there are routines which retrieve input from the interactive devices, including (X, Y) data, light-pen selects, and text output. This group of subroutines also supports the selective erase feature of DYNAGRAPHICS. Any element which has been defined as a picture or subpicture may be deleted, without affecting any other part of the display. (Pictures can also be made invisible, without deleting them from the display list. This allows you to redisplay a picture at a later time, if you choose).

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Terminal Software

The DYNAGRAPHICS terminal software is stored in an EPROM, and is loaded into the terminal's main memory at power-up, or when the terminal is restarted. A single depression of the RESTART switch on the keyboard restarts the terminal.

An additional terminal program may be stored on a separate EPROM. You might choose to have (as a second terminal program) our emulator for two popular storage-tube models. If you already have an investment in storage-tube software, this emulator can support your existing software while you are developing interactive graphics programs. This makes it easier for you to branch out into true interactive graphics.

Interactive Devices

The DYNAGRAPHIC™ series terminals feature a 92-key keyboard, including eight fixed-function keys and eight programmable lighted function keys.

In addition to the keyboard, your choice of a light pen or joystick is included in the terminal's base price (a data tablet is available at additional cost). Digitizers in several sizes, ranging from 20" x 20" to 42" x 60", are also available.

These interactive devices are controlled by the DYNAGRAPHICS terminal program. Input from the devices is interpreted by the terminal program, and is transmitted back to the host computer when requested.

You can choose the interactive devices which will make your system most productive.

Applications of DYNAGRAPHICS

The DYNAGRAPHICS host subroutines are straightforward, easy-to-use software tools designed to help you develop your applications programs in minimal time. Anything from individual applications programs to complete turnkey systems can be developed using DYNAGRAPHICS. To illustrate the variety of applications DYNAGRAPHICS can be used for, here are some current applications:

- **Pattern-Nesting**

  A leading software house which markets a turnkey system for shipbuilding applications plans to use DYNAGRAPHICS for pattern-nesting of ship parts on a piece of sheet metal. Working from a program-generated initial placement of parts, an operator, interacting with the display, will be able to optimize the placement of the parts on the sheet metal, and thereby minimize wasted material. Avoiding potential waste of material is so crucial that the software house must **buy** the sheet metal if it is responsible for unnecessary waste.

  When the pattern-nesting is complete, a cutting-tool path is generated automatically. The operator can view this tool path on the display to verify its accuracy.

- **Modeling/Simulation**

  A major manufacturer of electrical connectors uses DYANAGRAPHICS for tolerance-testing of new connectors. The mating of connectors is simulated, with the aid of a graphical display, both to observe the physical tolerances of the connector and to check for possible electrical shorts.

- **Architecture**

  A British firm uses DYNAGRAPHICS in their turnkey system which helps architectural firms prepare floor plans. Pre-defined symbols and figures (representing walls, windows, doorways, plumbing fixtures, furniture, etc.) can be placed into the drawing, and then interactively manipulated, until a final layout has been prepared. When the layout is completed, final drawings are generated automatically, using a digital plotter.

- **Circuit Design**

  Engineers at a major semiconductor manufacturer will use DYNAGRAPHICS to prepare schematics for input to a major turnkey manufacturer's system. Since the turnkey system is run by a centralized service group, engineers may have to wait days for their work to reach "the head of the queue". Using DYNAGRAPHICS, each engineer is able to input a schematic and get immediate feedback on a new design. If errors or design flaws are discovered, the schematic can be changed interactively, **before** the design is submitted to the central service group. DYNAGRAPHICS not only helps an engineer limit the number of passes a design must make through the central service group, it also helps the engineer imagine new ideas, due to the immediate feedback possible with DYNAGRAPHICS.

- **Oceanographic Research**

  The Woods Hole Oceanographic Institution on Cape Cod in Massachusetts uses DYNAGRAPHICS to study ocean dynamics. Scientists graphically examine the direction of ocean currents, water temperature and seismic data.

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Product Support

IMLAC has a product support staff which includes applications engineers and product specialists. These people are available to help explain how you can use DYNAGRAPHICS for your application and to answer questions which may arise when you are developing your own unique applications using DYNAGRAPHICS.

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